

Switching Electronics for Space-Based Telescopes with Advanced AO Systems, Phase II

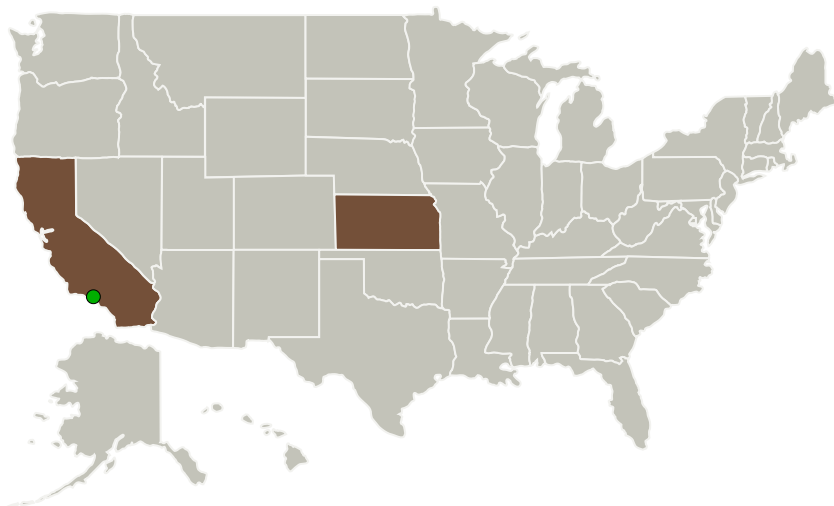
Completed Technology Project (2016 - 2018)



Project Introduction

A 32x32-channel multiplexing Application Specific Integrated Circuit (ASIC) driver, which can hold a voltage signal with a 16-bit resolution or beyond, is proposed. Such a driver will greatly reduce the operation power, and are compact and reliable. When the ASIC driver is vertically integrated with a Deformable Mirror (DM), the potential wiring failure will be eliminated. Furthermore, radiation resistance will be emphasized during ASIC design. During Phase I period, we had (1) verified the concept of the proposed floating driver for controlling an HV switch configured by a pair of transistors, (2) developed a high-voltage unity-gain buffer for tracing an isolated voltage signal, which is an essential tool towards developing switch arrays with high quality, (3) established the test methods for measuring switch parameters that directly impact the performance of a DM, (4) identified the main switch parameters, feedthrough and leakage, which are the primary impediments causing the drift of a stroke. All of the above made it possible for us to focus on (1) screen HV IC processes to find a qualified IC process with which a switch featuring low leakage can be fabricated, (2) apply decoupling technique to eliminate feedthrough, (3) manufacture an advanced 32x32 switch array with a voltage-resolution of 16-bit or beyond in Phase II.

Primary U.S. Work Locations and Key Partners



Switch parameters		Application specification	
Switch pitch (mm)	1	Actuator number	1024
dc offset	predictable	Stroke (μm)	±0.5 or 1
R_{on} (kΩ)	<4.2	Actuator pitch (mm)	1
Leakage (pA)	<1.5	Actuator capacitance (nF)	50
Feedthrough capacitance (pF)	<0.47	Operating voltage range (V)	±50/100V
Current pass capability (mA)	5~10	Voltage resolution (bit)	≥16
Voltage delivering range (V)	100	Frame rate (Hz)	0.05~1
Off-state power (μW)	<1	Total power (W)	<1

Table: The proposed 32x32 switch array with switch parameters designed for an assumed application

Switching Electronics for Space-based Telescopes with Advanced AO Systems, Phase II

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

Switching Electronics for Space-Based Telescopes with Advanced AO Systems, Phase II

Completed Technology Project (2016 - 2018)



Organizations Performing Work	Role	Type	Location
Sunlite Science & Technology, Inc.	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Lawrence, Kansas
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sunlite Science & Technology, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Haijing Ou

Co-Investigator:

Haijiang Ou

Primary U.S. Work Locations

California	Kansas
------------	--------

Images

Switch parameters		Application specification	
Switch pitch (mm)	1	Actuator number	1024
dc offset	predictable	Stroke (μm)	± 0.5 or 1
R_{on} ($k\Omega$)	< 4.2	Actuator pitch (mm)	1
Leakage (pA)	< 1.9	Actuator capacitance (nF)	50
Feedthrough capacitance (pF)	< 0.47	Operating voltage range (V)	± 50 100V
Current pass capability (mA)	5-10	Voltage resolution (bit)	≥ 16
Voltage delivering range (V)	100	Frame rate (Hz)	0.05-1
Off-state power (μW)	< 1	Total power (W)	< 1

Table: The proposed 32x32 switch array with switch parameters designed for an assumed application

Briefing Chart Image

Switching Electronics for Space-based Telescopes with Advanced AO Systems, Phase II

(https://techport.nasa.gov/image/133425)

Switching Electronics for Space-Based Telescopes with Advanced AO Systems, Phase II

Completed Technology Project (2016 - 2018)



Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX02 Flight Computing and Avionics
 - └ TX02.1 Avionics Component Technologies
 - └ TX02.1.6 Radiation Hardened ASIC Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System